

Appendix D

Development of an Integrated CSM

D-1. Introduction

The following is a hypothetical example for demonstration only. It is intended to illustrate how a team might begin the process of developing an integrated CSM. The reader is cautioned that CSM development should be based on site-specific parameters and information.

D-2. Background

a. Former Camp Swampy was a World War II facility for training of U.S. Army troops. The facility was declared excess in 1956, and in 1957 the property transferred to the local township Industrial Development Authority (IDA). The IDA transferred a small parcel in the southeast corner to a private landowner 2 years later. The remaining property has been subsequently leased to several commercial enterprises for various uses. An ASR conducted in 1993 identified a mortar range and OB/OD area at the former camp. Surface clearance had been conducted prior to transfer, and no OE items were known to remain at the site. In 2001, several explosions were heard during a prescribed burn in a forested area of the former installation. The detonations were suspected to be from mortar rounds on the property. Presented with this information, the IDA contacted the local district of the USACE for assistance. Since no extensive sampling investigation had been conducted prior to the transfer, the District initiated an integrated OE/HTRW investigation.

b. A PM from the geographic District was assigned overall management of the former Camp Swampy investigation. The OE project will precede the HTRW investigation. To initiate the project, the PM assembled a PDT (team) consisting of OE specialists, HTRW specialists, state and federal regulators, and representatives from the IDA, business owners, and local landowners at the site. The team's first order of business was to establish goals and objectives of the investigation to follow. One of the objectives was to develop a CSM to capture the source-receptor interactions to guide future data collection efforts. The team gathered all historical information available for the site, including aerial photographs from the operating period of the facility. The team then organized the available information into the following profiles.

D-3. Facility Profile

a. The team was able to determine current use and ownership of former Camp Swampy from existing information and a site visit. The majority of the 18,000-acre facility is leased from the IDA by a timber products company and used to grow pine trees. The timber products company also sub-leases this land to a local hunting club, which has a cabin on the northern boundary of the property. The acreage is not fenced, but there are locked gates across access roads through the property. The industrial area (the former cantonment area) still has several buildings that are in use at the site, also leased through the IDA. A metal fabrication shop occupies one building,

and a grocery storage company uses two warehouses and an office building. A 6-foot tall security fence surrounds the industrial area.

b. An existing map from 1943 for former Camp Swampy revealed the location of both the mortar firing line and the OB/OD area. The actual mortar range dimensions, however, were not documented. The map was updated with information the team had uncovered and is shown as Figure D-1. Because the detonations occurred during a controlled burn at the tree farm, the team hypothesized that cultivation and harvesting of the trees over the years resulted in relocation of OE items through disturbance of the soil. This activity, and the presence of the planted pines, had obliterated any ground scars that may have once existed at the site.

c. The team obtained a standard range layout for mortar ranges for the 1943–1945 period to establish approximate dimensions for this OE use area (Figure D-2). The team also noted that the standard layout was typically modified to meet site conditions. A typical mortar range has three areas of concern, the firing point (firing line), the impact area, and the danger area. The firing line is assumed to be 75 feet (25 yards) wide and the impact area (target area) is assumed to begin a minimum of 1800 feet (600 yards) from the firing point, continuing downrange the maximum distance of the mortars fired. These dimensions were estimated using an 81-mm HE, M43 mortar as worst case, which has a maximum range of 11,700 feet (3,300 yards). Regulations require that an additional 1800-foot (600-yard) danger area be applied to each side and to the downrange distance. The area of the explosions appeared to be consistent with the range impact area identified by the standard layout.

d. The OB/OD area was defined by operating manuals as a 400-foot diameter circle at the crest of a small hill. During the site visit, the team noted an area of bare, disturbed soil and stressed vegetation in this area. Five distinct mounds were visible that indicated debris burial from the OB/OD operation. The team hypothesized that the potential OE items included mortars, small arms, smokes, flares, and simulators as both broken and unfunctioned rounds. OE scrap was noted across the entire area. An accelerant, either gasoline or diesel fuel, was assumed to have been used to initiate the burns.

D-4. Physical Profile

a. The facility is located in an area of gently rolling hills, with topographic relief of not more than 50 feet. Coastal plain sediments dominate this area, with well-sorted sand being the dominant strata and major component of the soil. The rapid drainage characteristics of this soil make it an excellent medium for growing pine trees, a major industry of the area. In addition to the dense rows of pine trees, most of the acreage also supports thick underbrush that is periodically burned to allow better access to the trees.

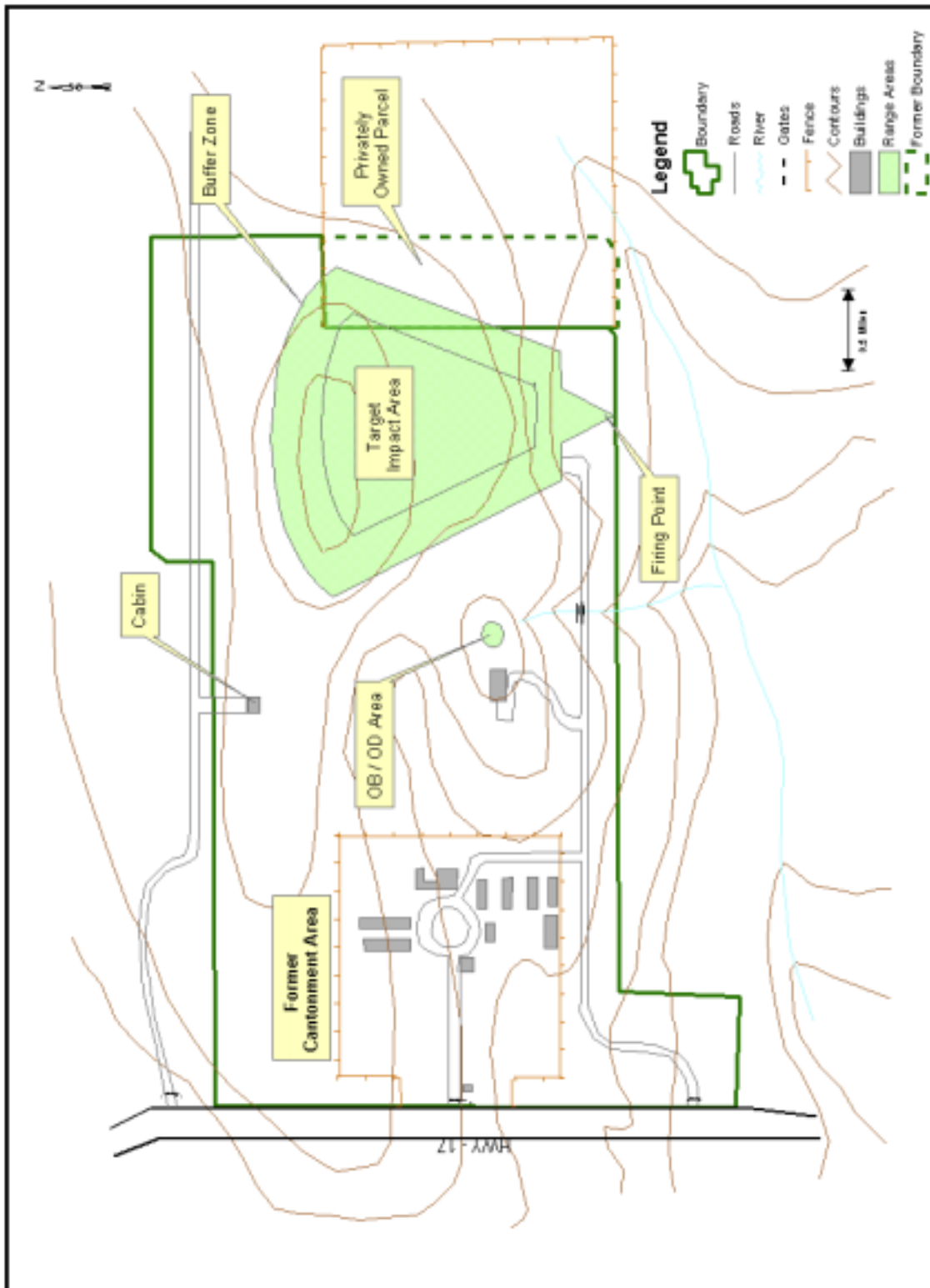


Figure D-1. Preliminary Site Map

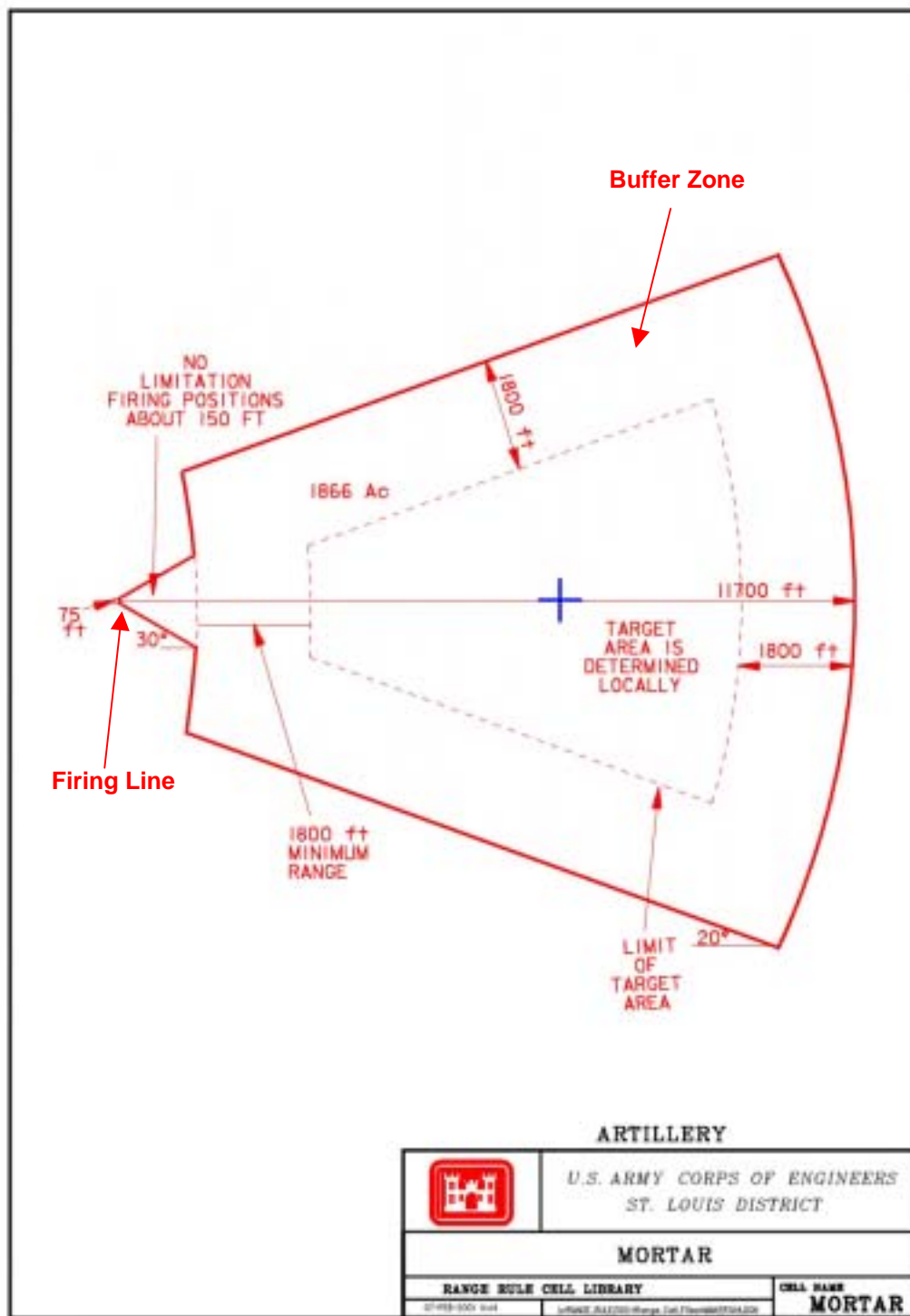


Figure D-2. Mortar Range

b. The team reviewed available state records of residential drinking water wells in the surrounding area and determined that ground water averaged 20–25 feet below ground surface. There are no wells in the former cantonment area, but it was discovered that a shallow water well exists at the cabin, presumably used during the hunting season.

c. A small creek originates about 150 feet southeast of the OB/OD area. Some red staining, thought to be iron oxide, was noted seeping from the creek bank downhill of the OB/OD area. The creek joins a river about 1.5 miles west of the facility. Despite the former camp's name, there are no wetland areas located at the property.

D-5. Release Profile

Using the Facility Profile information, the team identified the OE areas of concern as the former mortar range and the OB/OD area. The mortar range was further divided into two areas based on typical use, the hazards associated with that use, and potential source materials. These two areas are the firing line and the impact/target area. The probable locations of all source areas were placed on the site map for later confirmation.

D-6. Land Use and Exposure Profile

a. The team documented use of the former mortar range as managed forest lands, and the former OB/OD area as currently unused. The on-site population includes workers at the industrial area, but interviews with these personnel indicated that they do not utilize either area during work hours. Timber company workers occupy the areas of concern on those occasions when planting, harvesting, or the controlled burns occur. Recreational use (hunting and hiking) was also noted, although the team has not yet identified the extent of this site use.

b. The surrounding land use is agricultural, with 12 single-family homes located within a 3-mile radius of the property. These residents rely on private wells for their drinking water. The industrial area, however, is serviced by the municipal water supply system. The small creek traversing the site discharges to a river that is used extensively for recreation (boating, swimming, and fishing).

D-7. Ecological Profile

The Ecological Profile for former Camp Swampy includes a description of the managed pine forest habitat that occupies most of the acreage. Ecological receptors include game animals (e.g., deer, turkeys) and other terrestrial animals. Fish and other aquatic organisms inhabit the downstream river, which serves as a popular recreation area. No threatened or endangered species are known to utilize the area.

D-8. Pathway Analysis

Analysis of the profile information should allow the team to identify all source–receptor interactions (exposure pathways) for the site. An exposure pathway is the course a physical or chemical agent takes to contact a receptor. For OE, an exposure pathway must include a source, access, activity, and a receptor. Each pathway for HTRW must include a source, an exposure medium, an exposure route, and a receptor. The pathway may also include a release mechanism (e.g., volatilization) and a transport medium (e.g., air), if the point of exposure is not at the same location as the source. In preparation for the CSM, the team compiled the following.

D-9. OE Sources

Three source areas were identified. They are the firing line at the mortar range, the mortar impact area, and the OB/OD area. OE is expected in subsurface soils at the firing line, and both surface and subsurface soils at the impact area and OB/OD area. The exposure media for the mortar range areas are expected to include surface and subsurface soils, as well as ground water from leaching of the OE constituents and accelerants. The same exposure media are expected for the OB/OD area. Additionally, the bare soils at this area make releases to air a potential, as well as releases to surface water and sediments in the nearby creek.

- The firing line was hypothesized to potentially contain a burn area and burial pits. A burn area was common during training to dispose of excess propellant charges from the mortars. Disposal pits were another concern to the team. An uncommon but potential practice was to bury unused munitions near the firing point, rather than return these to the Ammunition Supply Point. This type of unsanctioned burial usually would occur near the firing point. The potential contaminants at the firing line area are explosive and propellant compounds, including trinitrotoluene, nitrocellulose, nitroglycerin, dinitrotoluene, as well as fuels and metals. The potential for OE items buried at the firing line to function is low because the expected items are probably unfuzed, and if fuzed, would not have been subjected to the forces required to arm the fuzes.
- The expected contaminants at the impact area include TNT and its breakdown products, and this area is also suspected of having a serious explosive safety hazard from UXO resulting from dud-fired rounds or incomplete detonation. The team will evaluate site conditions to determine the expected depth of penetration of OE at the impact area.
- The OB/OD area is identified as a third source area at the site. Probable source materials at this area include all types of munitions used at the installation (e.g., mortars, small arms rounds, smokes, flares), due to kick-outs during operations. The potential for OE items functioning was also noted as low because the expected items are probably unfuzed, and if fuzed, would not have been subjected to the forces required to arm the fuzes.

a. Interaction. The source–receptor interactions for an OE site require access and activity.

(1) *Access.* Currently, access to the source areas is unlimited. Future access restrictions are unlikely as well, as the reasonable future site use is expected to remain the same.

(2) *Activity.* Current and future activities that can bring receptors into contact with OE are tree farm activities (cultivation/planting of trees, harvesting of the trees, and conduct of the occasional controlled burns), as well as recreational site use, whereby hunters can contact OE items at the ground surface.

b. Receptors. On-site tree farm workers have the greatest exposure potential since their jobs entail intrusive work. On-site recreational users and off-site residents have the potential for exposure; however, their on-site activities would make it less likely for direct contact with OE.

D-10. HTRW Sources

HTRW source areas are the same as those for OE. The firing line at the mortar range has the potential for release of HTRW into the surface and subsurface soils. Contaminants at this area are expected to be explosives and propellants and their breakdown products. This area is also suspected of containing an accelerant, probably diesel fuel, to facilitate burns. At the mortar impact area, the team expects TNT and its breakdown products to be found in surface and subsurface soils. The third source area is the OB/OD area. Both surface and subsurface soil are expected to contain explosives, their breakdown products, and metals. Fuel contamination from an accelerant is also likely at this location. The team also documented the red staining at the creek so that future site investigations can verify its composition.

a. Interaction. The source–receptor interactions at an HTRW site require an exposure medium (or media) and an exposure route.

(1) *Exposure Media.* Exposure media are those that contain the source, or those media that become contaminated through migration of the contaminant from the source area. The team identified the exposure media to be:

- Surface and subsurface soils at all three source areas.
- Surface water and sediments at the creek (via overland flow of contamination in surface soils, and the red staining at the bank).
- Air (via volatilization and particulate resuspension from surface soils).
- Ground water (via leaching from surface and subsurface soils).
- Food chain (via plant uptake from soils, contaminated fish and wildlife consumption, and contaminated domestic animal consumption).

(2) *Exposure Routes.* Exposure routes are those processes by which a contaminant or physical agent comes in contact with a receptor. For most environmental contaminants, these processes include ingestion, inhalation, and dermal contact. Ingestion is applicable to all expo-

sure media except air. Dermal contact is applicable to all exposure media except air and food chain. Inhalation is applicable to air, soils, and ground water.

b. Receptors. Current receptors to HTRW contamination are tree farm workers and recreational users (hunters at the cabin). Although site use is expected to remain commercial/industrial, the HTRW investigation will look at potential residential use, to possibly eliminate the need for deed restrictions and 5-year reviews.

D-11. Integrated Conceptual Site Model

Once the pathway analysis was completed, the team developed a graphic CSM component that integrated the profiles to illustrate all source-receptor interactions at the site. Figure D-3 provides a graphic representation of these interactions for the OB/OD unit, one of the three source areas. This graphic, along with the accompanying profile narrative and maps, form the CSM for this source area.

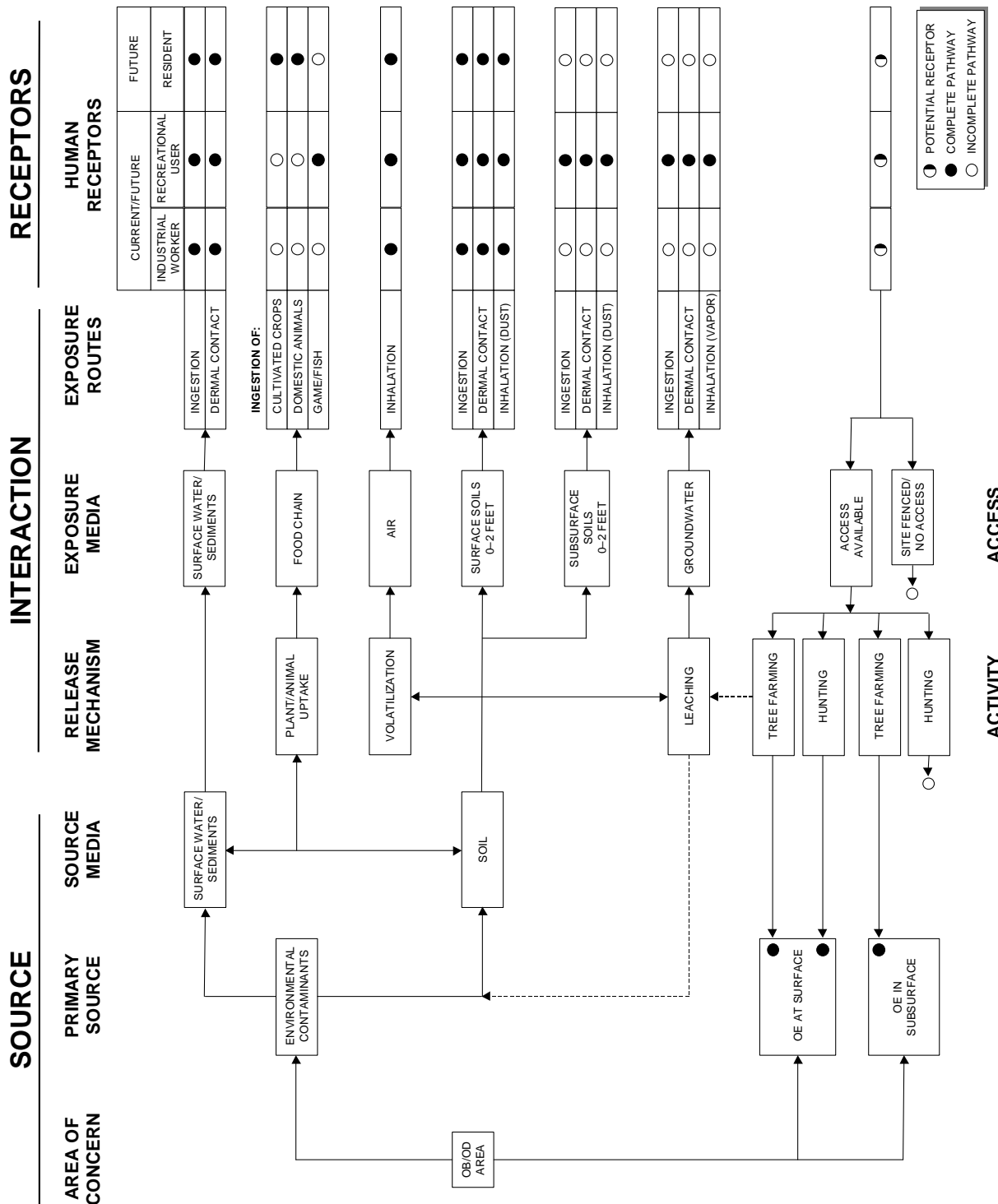


Figure D-3. Source-Receptor Relationships for OE and HTRW Sites